A Fertility Test for Beneficial Insects

Insect predators are used in biological control to suppress pests in fields and greenhouses. These beneficial insects are mass reared commercially, and producers need to be able to assess the quality of their insects. One way to do this is to look at reproductive rates. But it's obviously difficult and time consuming to measure rates of egg production in a very small insect.

Instead, entomologists Jeffrey P. Shapiro and Stephen M. Ferkovich developed enzyme-linked immunosorbent assays (ELISAs) that measure yolk proteins in insects' blood (hemolymph) or whole bodies. Yolk protein levels predict reproductive response to artificial and natural diets and the resulting variations in fertility. Shapiro and Ferkovich are with ARS' Behavior and Biocontrol Research Unit at the Center for Medical, Agricultural, and Veterinary Entomology in Gainesville, Florida.

ELISAs are sensitive laboratory tests that use antibodies to detect and measure antigens in samples. In this case, Shapiro and Ferkovich used monoclonal antibodies to measure very small quantities of the yolk proteins. Other scientists have used ELISAs to measure yolk protein levels in insects, but this is the first time one has been used to predict reproductive fitness of mass-reared predators or parasitoids.

Beneficial insects are fed a range of artificial diets. Shapiro says short-term changes in yolk proteins occur after adult females feed. Bugs produce large amounts of yolk proteins on nutritious diets and less on less-nutritious diets. The ELISAs gauge the amount of yolk protein in female insects and reveal how many offspring they are capable of producing.

Artificial diets have advantages over natural-prey diets, especially if costs can be reduced and the quality of the resulting insects can be maintained. Artificial diets—typically containing ground beef, beef liver, and chicken eggs—may cost less than natural-prey diets and are more efficient and easier to control. But the proper nutrients must be included to stimulate the normal life cycle of the insect.

"Our approach is to try to isolate critical chemicals present in the insects' natural hosts and replicate them in nutritious diets with artificial ingredients," Shapiro says.

The monoclonal antibodies used to develop the ELISAs came from the yolk proteins vitellin and vitellogenin of the spined soldier bug, *Podisus maculiventris,* and the minute pirate bug, *Orius insidiosus*. Both of these bugs are used as biocontrols against a wide variety of crop pests.

"Our ELISAs determine the reproductive fitness of female insects," Shapiro says. "It's a quality-control practice—like the ones used in other industries to produce a superior product. Growers will see the results in the field and develop more confidence in using beneficial insects or arthropods."

ARS is licensing the antibodies, but they will not be patented. ARS is negotiating with a company to develop a commercial test, which should be available this year, to analyze insectaries' samples and tell them if the beneficial insects meet set standards.—By **Jim Core,** ARS.

This research is part of Crop Protection and Quarantine, an ARS National Program (#304) described on the World Wide Web at www.nps.ars.usda.gov.

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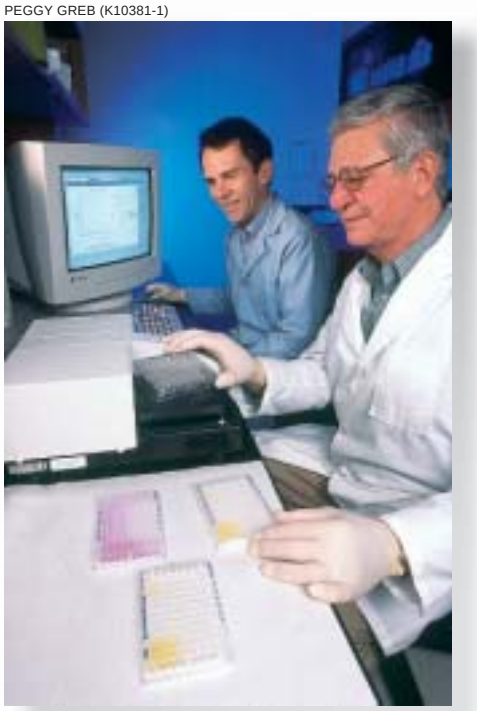
PEGGY GREB (K10381-1)



Entomologists Jeffrey Shapiro (left) and Stephen Ferkovich examine ELISA plates scanned in a microplate reader. The intensity of color in each sample is proportionate to yolk protein content in a predatory bug.